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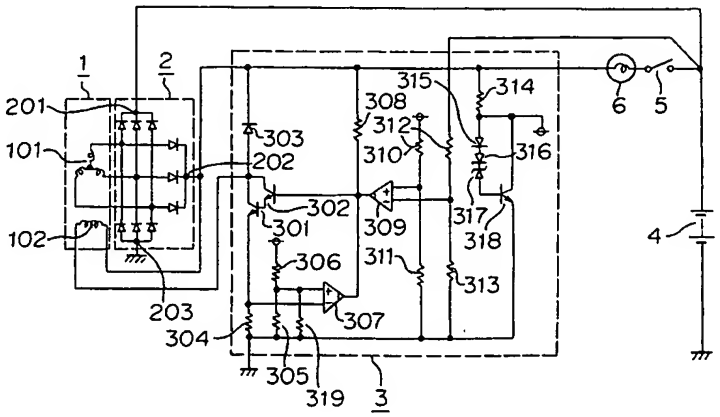
(54) **A control device for an alternating current generator of a vehicle.**

(57) A control device for an alternating current generator of a vehicle, having a storage battery (4) which is charged by a rectified output of the alternating current generator. (1), a current detecting resistance (304) wherein current substantially equal to a field current flowing in a field coil (12) of the alternating current generator, flows and which has a temperature coefficient, voltage setting means (305,306,319) for setting a reference voltage for comparison, and a comparator (307) for comparing a both terminal potential difference of the current detecting resistance (304) with the reference voltage for comparison, which restricts the field current of the alternating current generator by interrupting the field current based on a comparison result of the comparator, characterized in that the voltage setting means (319) changes the reference voltage for comparison in accordance with temperature to compensate a temperature gradient of the both terminal potential difference of the current detecting resistance (304).

FIGURE 1



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This invention relates to a control device for an alternating current generator of a vehicle, particularly to a control of a field current of an alternating current generator.

Figure 2 is a circuit diagram showing construction of a conventional control device for an alternating current generator of a vehicle. In Figure 2, a reference numeral 1 designates an alternating current generator having an armature coil 101 in star connection and a field coil 102, and 2, a rectifier composed of a three-phase full-wave bridge rectifier which is consisted of three sets of three series diodes connected to the armature coil 101, having a main rectified output terminal 201, and an auxiliary rectified output terminal 202 and a grounded output terminal 203 of the bridge rectifier.

A reference numeral 3 designates a voltage regulator which controls an output voltage of the alternating current generator to a predetermined value by controlling the field current flowing in the field coil 102, 4, a battery charged by a rectified output of the alternating current generator, 5, a key switch, and 6, a charge display lamp.

Numerals 301 and 302 designate transistors composed in darlington connection which interrupt the field current flowing in the field coil 102 of the alternating current generator 1, 303, a field discharge diode, and 304, a current detecting shunt resistance as a current detecting resistance, being inserted between the emitter of the transistor 301 and the ground, and having a positive temperature coefficient. Numerals 305 and 306 designate voltage dividing resistances for setting a reference voltage for comparison by dividing a reference voltage, having a positive temperature coefficient, 307, a comparator for comparing the divided voltage with a both terminal potential difference of the current detecting shunt resistance 304, and 308, a resistance for initial excitation of which one end is connected to the base of the transistor 302, and both output terminals of the comparator 307 and a comparator 309.

Numerals 310 and 311 designate resistances which divide a reference voltage, and 312 and 313, resistances which divide a voltage of the battery 4. The comparator 309 makes a comparison between these divided voltages. A numeral 314 designates a resistance, 315 and 316, diodes, 317, a zener diode, and 318, a transistor, which form a reference voltage based on the voltage of the battery 4.

One end of the field coil 102 of the alternating current generator 1 is connected to the collectors of the transistors 301 and 302, and an anode of the field discharge diode 303. The other end thereof is connected to the auxiliary rectified output terminal 202, the cathode of the field discharge diode 303, and the other end of the resistance 308, as well as to the positive pole of the battery 4 of which negative pole is grounded, through the charge display lamp 6 and the key switch 5. Furthermore, the main rectified current output terminal 201 of the rectifier 2 is connected to the positive pole of the battery 4.

Next, explanation will be given to the operation referring to Figure 2. When the key switch 5 is switched to ON, base currents flow to the transistors 302 and 301 from the battery 4 through the key switch 5, the charge display lamp 6, and the resistance 308, successively. An initial excitation current is flown in the field coil 102 by switching the transistors 302 and 301 to ON. When the alternating current generator 1 is driven by an engine, not shown, in this state, power generation starts.

When power is generated, an emitter current of the transistor 301 which is correlated with the field current flowing in the field coil 102, that is, approximately equal to the field current, flows in the current detecting shunt resistance 304. Therefore, the potential difference is generated between both ends of the current detecting shunt resistance 304. This potential difference is compared with a divided point potential of the voltage dividing resistances 306 and 305 by the comparator 307. When the potential difference becomes higher than the divided point potential by the increase of the field current, an output of the comparator 307 becomes "L" level, and the comparator 307 switches the transistors 302 and 301 to OFF, and cuts off the field current to restrict the field current to a predetermined value. When the transistors 301 and 302 are switched to OFF, the output of the comparator 307 is reversed to "H" level again, switches the transistors 302 and 301 to ON again, and flows the field current in the field coil 102.

By repeating the above operation, the field current is controlled so that it is restricted to a predetermined value, and the output voltage of the alternating current generator is controlled to a predetermined value. The alternating current signal generated by the alternating current generator 1, is rectified to a direct current by the rectifier 2, charges the battery 4 and activates the field coil 102.

Furthermore, when a charged voltage of the battery 4 becomes a predetermined value or more, the comparator 309 outputs the "L" level, and switches the transistors 302 and 301 to OFF. Furthermore, a circuit composed of the zener diode 317, the transistor 318 and the like, operates to maintain constant the reference voltage based on the voltage of the battery 4.

The conventional control device for an alternating current generator of a vehicle is constructed as above, and the current detecting shunt resistance 304 is provided with a low value of 10 to 100 mΩ to

reduce a loss thereby. In a hybrid IC, generally, a conductor resistance of Ag/Pd utilized as an electrode material is in use. On the other hand, the voltage dividing resistances 305 and 306 forming a reference voltage for comparison, has a positive temperature coefficient of about 200 PPM. Since the voltage dividing resistances 305 and 306 are provided on the top side and the bottom side of the voltage dividing point, which compensate an influence by temperature, the voltage detecting level is not varied with temperature. However, the conductive resistance utilized as the temperature detecting shunt resistance 304, has a positive temperature coefficient of about 500 PPM. Therefore, with increase of temperature, an operating current value for the "L" level of the comparator 307 is decreased, and a negative temperature gradient is provided in a field current restricting value.

It is an object of the present invention to solve the above problems. It is an object of the present invention to provide a control device for an alternating current generator of a vehicle capable of restricting the field current without being influenced by temperature.

According to an aspect for the present invention, there is provided a control device for an alternating current generator of a vehicle, having a storage battery which is charged by a rectified output of the alternating current generator, a current detecting resistance wherein current substantially equal to a field current flowing in a field coil of the alternating current generator, flows and which has a temperature coefficient, voltage setting means for setting a reference voltage for comparison, and a comparator for comparing a both terminal potential difference of the current detecting resistance with the reference voltage for comparison, which restricts the field current of the alternating current generator by interrupting the field current based on a comparison result of the comparator, characterized in that the voltage setting means changes the reference voltage for comparison in accordance with temperature to compensate a temperature gradient of the both terminal potential difference of the current detecting resistance.

In the control device for the alternating current generator of a vehicle of this invention, the both terminal potential difference of the current detecting resistance is increased with the increase of temperature, and the reference voltage for comparison increases to compensate the increase of the both terminal potential difference by the voltage setting means, by which the field current is reversed to a constant field current restricting value wherein the comparison of the both potentials is not influenced by temperature.

In the drawings:

Figure 1 is a circuit diagram showing an embodiment of a control device for an alternating generator of a vehicle according to the present invention; and

Figure 2 is a circuit diagram showing a conventional device.

Explanation will be given to an embodiment of the present invention referring to the drawings as follows.

In Figure 1, portions being the same or the corresponding with those in the conventional example, are attached with the same notations as in Figure 2; 1 to 6, 101, 102, 201 to 203 and 301 to 318, and the explanation is omitted. In the voltage dividing resistances 305 and 306 for setting the reference voltage for comparison, a semiconductor resistance 319 having a positive temperature coefficient of about 2000 PPM, is connected in parallel to the voltage dividing resistance 305 on the lower potential side (A thick film resistance is used in this example.). The other construction is the same with that in the conventional example, and the explanation is omitted.

Next, explanation will be given to the operation of the embodiment referring to Figure 1. However, expalnation duplicated with the conventional example is omitted. The comparator 307 compares the both terminal potential difference of the current detecting shunt resistance 304, with the reference voltage for comparison formed by dividing the reference voltage by the voltage setting means composed of a parallel connected body of the voltage dividing resistance 305 and the semiconductor resistance 319 and the voltage dividing resistance 306, and outputs the comparison result to the base of the transistor 302.

At this occasion, when a constant current flows in the current detecting shunt resistance 304, the both terminal voltage difference of the current detecting shunt resistance 304 increases with increase of temperature due to the temperature coefficient of about 500 PPM. Accordingly, a resistance value of a series parallel circuit of the voltage dividing resistances 306 and 305 having the temperature coefficient of about 200 PPM and the semiconductor resistance 319 having the temperature coefficient of about 2000 PPM is to be designed in optimum, to compensate the increase of the both terminal potential difference by the increase of the reference voltage for comparison. In this way, it becomes possible to compensate the negative temperature gradient of the field current restricting value due to the temperature coefficient of about 500 PPM of the current detecting shunt resistance 304.

As stated above, according to the present invention, the reference voltage for comparison is changed with temperature to compensate the temperature gradient of the both terminal potential dif-

ference of the current detecting resistance, and the field current of the alternating current generator is interrupted based on the comparison result of the both terminal potential difference of the current detecting resistance and the reference voltage for comparison. Accordingly, the invention has an effect wherein the nagative temperature gradient of the field current restricting value due to the positive temperature coefficient of the current detecting resistance, can be compensated.

Claims

1. A control device for an alternating current generator of a vehicle, having a storage battery which is charged by a rectified output of the alternating current generator, a current detecting resistance wherein current substantially equal to a field current flowing in a field coil of the alternating current generator, flows and which has a temperature coefficient, voltage setting means for setting a reference voltage for comparison, and a comparator for comparing a both terminal potential difference of the current detecting resistance with the reference voltage for comparison, which restricts the field current of the alternating current generator by interrupting the field current based on a comparison result of the comparator, characterized in that the voltage setting means changes the reference voltage for comparison in accordance with temperature to compensate a temperature gradient of the both terminal potential difference of the current detecting resistance.

FIGURE 1

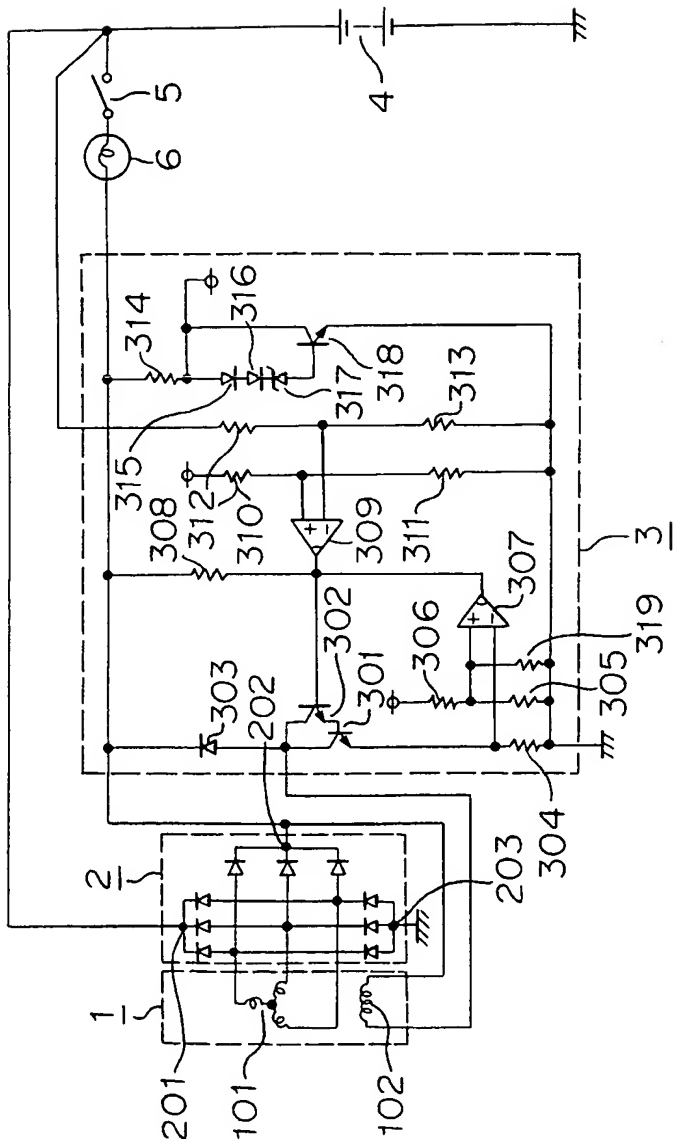
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FIGURE 2

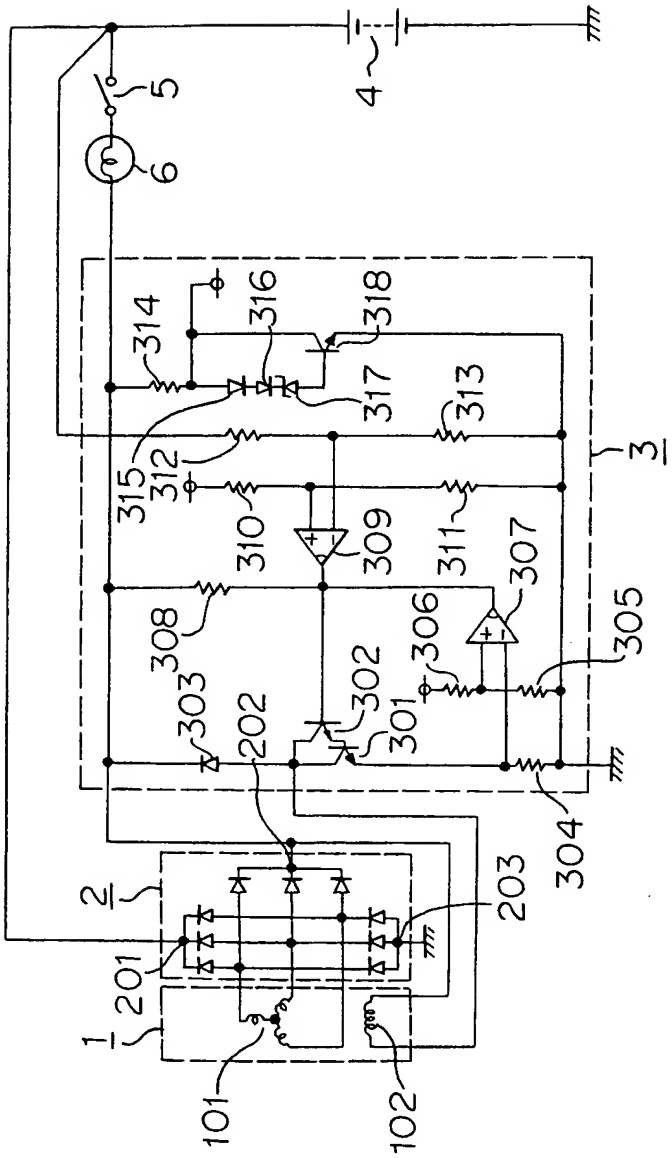
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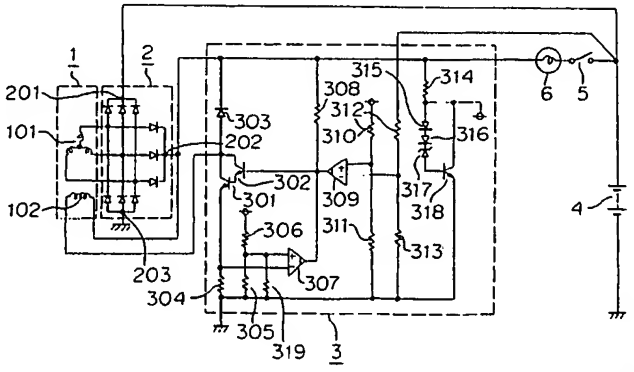
FIGURE 1



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EUROPEAN SEARCH REPORT

Application Number

EP 92 11 1308

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-2 172 416 (SGS MICROELETTRONICA S.P.A.) * page 1, line 79 - page 2, line 92; figure 1 *	1	H02J7/14 H02J7/16
A	FR-A-2 420 874 (SOCIETE POUR L'EQUIPEMENT DE VEHICULES) * page 4, line 26 - page 8, line 31; figures 1-4 *	1	
A	EP-A-0 081 891 (MOTOROLA) * page 7, line 23 - page 10, line 26; figures 1-5 *	1	
A	DE-A-3 309 447 (MITSUBISHI) * page 9, line 2 - page 17, line 34; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H02J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 FEBRUARY 1993	CALARASANU

CATEGORY OF CITED DOCUMENTS

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